

Docket No. F-9089

Ser. No. 10/578,047

REMARKS

Claims 8-13 and 18-23 are now pending in this application. Claims 14-17 are cancelled herein. Claims 1-7 are previously cancelled. Claim 23 is added. Claims 8-22 are rejected. Claims 8 and 18 are amended herein to clarify the invention. Claim 12 is amended to address an informality.

Applicants respectfully submit that, upon entry of the subject amendment, the application will be in condition for allowance. Applicants, thus, respectfully request consideration of the above amendment and the following remarks.

Amendments to the Claims

Claims 8 and 18 are amended to include the limitations of claim 14. Claims 15-17 added the same limitations as claim 14, and thus are canceled. No new matter is added. No new issues are raised.

Claim 12 is amended to change the dependency to claim 8.

New claim 23 depends from claim 18, and adds limitations found in claim 22. No new matter is added. Because the limitations have already been considered with regard to claim 22, no new issues are raised.

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Subject Matter of the Claimed Inventions

The claimed inventions are directed to a method and apparatus for processing a surface of a substrate with an ion beam. The substrate surface has known property patterns. A new property pattern is achieved by processing the surface with the ion beam.

An ion probe array measures a current geometric action pattern of the ion beam. The geometric action pattern of the ion beam then is adjusted based on the measured geometric action pattern and the known pattern of properties of the substrate surface. Such adjustment includes varying local ion current density distributions within an ion beam cross section to cause a corresponding variation of ion energy distribution at defined surface area regions of the substrate that ions of the ion beam act upon.

Prior art Rejections and the Cited Art

Claims 8, 9, 11, 12, 14, 16 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cohen et al. (U.S. Patent No. 3,699,334) in view of Smirnov et al. (U.S. Patent No. 6,274,007). The rejections are respectfully traversed.

Claims 10, 13, 15 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cohen et al. in view of Smirnov et al., and further in view of Reade et al. (U.S. Patent No. 6,809,066) or Muraki et al. (European Patent EP 1 253 619). The rejections are respectfully traversed.

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Claims 18, 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itoh et al. (U.S. Patent No. 5,223,109) in view of Smirnov et al. and Cohen et al. The rejections are respectfully traversed.

Each of these references has been characterized in the prior Amendment.

The Claims Distinguished

The Examiner cites Smirnov et al. as teaching measuring a current geometric action pattern at a substrate surface with an ion probe array during the course of processing the substrate. We note that Smirnov et al. discloses detecting a secondary ion emission signal from an insulator layer and terminating sputtering when the detected signal reaches a predetermined threshold value, (Col. 4, lines 50-56). Thus, such measurement is used to determine when to terminate Smirnov et al.'s sputtering process.

Of significance is that such measurement is not used to achieve a new technically defined pattern of properties, which would require there to be ongoing processing after the measurement. Also of significance is that the Smirnov et al. measurement is not used as a basis for varying an ongoing geometric action pattern, and thus does not serve as a basis for varying local ion current density distributions within an ion beam cross section. Also of significance is that detecting when a secondary ion emission surpasses a threshold value does not read

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on the limitation - measuring a current **geometric action pattern**. It is respectfully submitted that none of the cited art discloses feeding back the current geometric action pattern occurring at a substrate surface to control the properties of an ion beam used for processing the substrate surface.

Claim 8 distinguishes over the cited art based at least upon the following claim limitations:

- measuring a **current geometric action pattern** of the ion beam with an ion probe array during processing of the substrate; and
- **adjusting the geometric action pattern of said ion beam based on the measured geometric action pattern and the known pattern of properties, said adjusting comprising varying local ion current density distributions within an ion beam cross section, thereby causing a corresponding variation of ion energy distribution at defined surface area regions of the substrate that ions of the ion beam act upon; and**
- **wherein the current geometric action pattern of said ion beam on the surface of the substrate is measured prior to and/or during the course of said method by the ion probe array, which is arranged in a plane of the surface of the substrate to be processed.**

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It is respectfully submitted that the cited art does not disclose measuring a current geometric action pattern during processing of a substrate, nor adjusting the geometric action pattern based on the measured geometric action pattern and known substrate properties. It also is respectfully submitted that the cited art does not disclose varying local ion current density distributions within an ion beam cross section during substrate processing based on such measured geometric action pattern.

It also is respectfully submitted that the cited art does not disclose varying local ion current density distributions within an ion beam and correspondingly varying ion energy distribution at defined surface area regions of the substrate corresponding to those local ion current density distributions.

Claims 9-13 and 22 ultimately depend from claim 8, and distinguish over the cited art based at least upon the same reasons as given for claim 8.

Claim 22 further distinguishes over the cited art based at least on the following claim limitations:

- varying ion acceleration, ion energy distribution, ion current density, and ion density distribution of the ion beam; and
- wherein said adjusting the geometric action pattern is performed as a function of the known pattern of properties, the method progression, and the current geometric action pattern of the ion beam to achieve the new technically defined pattern of properties.

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It is respectfully submitted that the cited art does not disclose varying ion acceleration, ion energy distribution, ion current density, and ion density distribution of the ion beam as a function of the known pattern of properties, the method progression, and the current geometric action pattern of the ion beam to achieve the new technically defined pattern of properties.

Claim 18 distinguishes over the cited art based at least upon the following claim limitations:

- an ion probe array arranged in a plane of the substrate surface and **positioned to measure a current geometric action pattern** of the ion beam; and
- means for **adjusting the geometric action pattern** of said ion beam prior to and during said ion beam processing of said substrate surface **based on the measured geometric action pattern** and a known pattern of properties of the substrate surface, said adjusting means **varying local ion current density distributions within an ion beam cross section, thereby causing a corresponding variation of ion energy distribution at defined surface area regions of the substrate that ions of the ion beam act upon.**

It is respectfully submitted that the cited art does not disclose measuring a current geometric action pattern during processing of a substrate, nor adjusting the

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geometric action pattern based on the measured geometric action pattern and known substrate properties. It also is respectfully submitted that the cited art does not disclose varying local ion current density distributions within an ion beam cross section during substrate processing based on such measured geometric action pattern. It also is respectfully submitted that the cited art does not disclose varying local ion current density distributions within an ion beam and correspondingly varying ion energy distribution at defined surface area regions of the substrate corresponding to those local ion current density distributions.

Claims 19-21 and 23 ultimately depend from claim 18 and distinguish over the cited art based at least upon the same reasons as given for claim 18.

Claim 23 further distinguishes over the cited art based at least upon the following claim limitations:

- said adjusting means varies ion acceleration, ion energy distribution, ion current density, and ion density distribution of the ion beam to achieve the adjusted geometric pattern.

It is respectfully submitted that the cited art does not disclose adjusting the geometric action pattern of said ion beam prior to and during said ion beam processing based on the measured geometric action pattern by varying ion acceleration, ion energy distribution, ion current density, and ion density distribution of the ion beam.

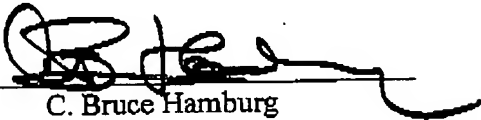
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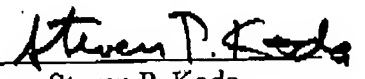
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No fee is believed due. If there is any fee due the USPTO is hereby authorized to charge such fee to Deposit Account No. 10-1250.


In light of the foregoing, the application is now believed to be in proper form for allowance of all claims and notice to that effect is earnestly solicited.

Respectfully submitted,
JORDAN AND HAMBURG LLP

By 
C. Bruce Hamburg
Reg. No. 22,389
Attorney for Applicants
and,

By 
Steven P. Koda
Reg. No. 32,252
Attorney for Applicants

Jordan and Hamburg LLP
122 East 42nd Street
New York, New York 10168
(212) 986-2340


Reg No 22,389